

Plant Assessment Form


For use with the “Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands”
by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association
(Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial):	<i>Linaria dalmatica</i> (L.) P. Mill. (USDA 2005)
Synonyms:	<i>Linaria genistifolia</i> (L.) P. Mill. ssp. <i>dalmatica</i> (L.) Maire & Petitm. (USDA 2005)
Common names:	Dalmatian toadflax, butter and eggs, broad-leaved toadflax
Evaluation date (mm/dd/yy):	05/05/03
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Committee review date:	06/23/04
List date:	06/23/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	B	Other published material	“Impact” Section 1 Score: B	“Plant Score” Overall Score: Medium Alert Status: None
1.2	Impact on plant community	A	Other published material		
1.3	Impact on higher trophic levels	B	Other published material		
1.4	Impact on genetic integrity	D	Other published material		
2.1	Role of anthropogenic and natural disturbance	B	Other published material	“Invasiveness” <i>For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:</i> 14 pts Section 2 Score: B	 Something you should know.
2.2	Local rate of spread with no management	B	Observational		
2.3	Recent trend in total area infested within state	B	Observational		
2.4	Innate reproductive potential	A	Reviewed scientific publication		
2.5	Potential for human-caused dispersal	A	Other published material		
2.6	Potential for natural long-distance dispersal	C	Observational		
2.7	Other regions invaded	C	Observational		
3.1	Ecological amplitude	A	Observational	“Distribution” Section 3 Score: A	
3.2	Distribution	A	Observational		

Red Flag Annotation

Linaria dalmatica occurs within a variety of ecosystems/plant communities that experience different natural fire regimes. *Linaria dalmatica*, however, established in these various ecological types after the onset of habitat alteration and fire exclusion that characterizes these types today. Because *L. dalmatica* was not present when historic (natural) fire regimes were functioning, it is unclear how the presence of *L. dalmatica* might affect the ability to restore a natural fire regime. Little empirical evidence exists to

enable anticipating these potential effects. The expanding wildland-urban interface and projected increases in the intensity of forest restoration/fuel treatments may provide new opportunities for *L. dalmatica* to spread into forested areas. Only a portion of *L. dalmatica* seeds may germinate in any given year. As a result, dormant seeds may germinate at sites following herbicide applications or other site disturbances that reduce native plant competition.

Table 3. Documentation

Note: Several sources describe *Linaria dalmatica* and *L. vulgaris* collectively. Although these species may be similar in some aspects, they were not evaluated collectively here particularly because they have different distributions in Arizona. When referring to information not specific to *L. dalmatica* (Dalmatian toadflax), but *Linaria* in general, which includes *L. vulgaris*, the term *Linaria* (toadflax) will be used.

Grieshop and Nowierski (2002 in Zouhar 2003) found, under the field conditions of their two-year study, that Dalmatian toadflax populations filled most "safe seedling emergence sites" and seedling recruitment of Dalmatian toadflax was limited more by interspecific resource competition than by seed numbers. Because Dalmatian toadflax can produce enough seeds to exceed potential emergence sites, and because Dalmatian toadflax plants reproduce vegetatively, it appears that individual seedling recruitment in Dalmatian toadflax is more important for establishing new populations than it is for maintaining established populations (Grieshop and Nowierski 2002).

Question 1.1 Impact on abiotic ecosystem processes	<i>Score: B Doc'n Level: Other pub.</i>
Identify ecosystem processes impacted: Soil moisture; altered fire regime.	
<p>Rationale: Mature toadflax plants have extensive, well-developed root systems. Taproots of a mature Dalmatian toadflax plant may reach depths of 4 to 10 feet (1.3 to 3 m), and lateral roots can extend 12 feet (3.6 m) from the parent plant (penetrating horizontally into several soil profiles). Vegetative buds were found as deep as 6 feet (1.8 m) in coarse soil. However, most Dalmatian toadflax plants produced from vegetative buds occur on lateral roots that are found in the upper 2 to 12 inches (5 to 30 cm) of soil (Alex 1962, Robocker 1974). While this may help stabilize soil in sparsely vegetated areas, it can increase soil erosion, surface runoff and sediment yield in sod-forming or bunchgrass communities that are replaced with toadflax (Saner et al. 1995, Lajeunesse 1999). The extensive root systems allows toadflax to exploit water resources efficiently (Zouhar 2003). The adventitious buds on roots allow for <i>L. dalmatica</i> to form dense colonies (Zouhar 2003)</p> <p>Presence of <i>L. dalmatica</i> in the understory may disrupt the surface fire patterns (J. Springer, personal communication, 2004) currently surface fire is a patchy occurrence but with fuel reduction treatments this could have a larger impact and more continuous surface fire patterns. Response of toadflax to fire may depend on site characteristics and the fire adaptations of other species in the plant community. Most reviews suggest that toadflax is likely to increase or to be unaffected by fire. Several studies provide examples of toadflax establishment following fire. See Zouhar (2003) for several examples of each.</p>	
Sources of information: See cited literature. Also considered personal communication with J. Springer Senior Research Specialist, Ecological Restoration Institute, Northern Arizona University, Flagstaff, Arizona, 2004).	

Question 1.2 Impact on plant community composition, structure, and interactions	<i>Score: A Doc'n Level: Other pub.</i>
Identify type of impact or alteration: Severe alteration of composition and interactions; formation of patches dominated by the species (>75% relative cover).	
<p>Rationale: Seedlings are considered ineffective competitors of soil moisture with established perennials and winter annuals. Mature plants of <i>L. dalmatica</i> are particularly competitive with winter annuals and shallow-rooted perennials (Robocker 1974). Once established <i>Linaria</i> suppresses other</p>	

vegetation mainly by intense competition for limited soil water (Carpenter and Murray 1998) primarily as a function of its deep tap root and extensive lateral roots (roots can grow 20 inches deep or more nine weeks after seedlings have emerged), which efficiently exploit water. Personal observations by B. Phillips and L. Moser in Coconino National Forest (2002 to 2003) agree with these findings

The roots of *L. dalmatica* (and *L. vulgaris*) are colonized by vascular-arbuscular mycorrhizal fungi, probably less in cultivated soils than in less disturbed areas. (Harris and Clapperton 1997 in Zouhar 2003). An aggressive invader that is capable of forming colonies through adventitious buds from creeping root system (Carpenter and Murray 1998, Zouhar 2003). This has also been observed in National Forests in northern Arizona (B. Phillips, L. Moser, and other Working Group members, personal observations, 2002 to 2003). Seeds are vulnerable to dehydration and competition from other species (Zouhar 2003). *Linaria dalmatica* establishment and survival depends on favorable precipitation or lack of competition from other plants (Robocker 1970).

From Zouhar (2003) and verified in Robocker (1970, 1974): “Dalmatian toadflax seedlings died following rapid or extreme temperature changes or dehydration in field and greenhouse studies. When Dalmatian toadflax seeds germinate in autumn, seedling survival the next year depends on sufficient spring and early summer precipitation, or a lack of competition from other plants. Dalmatian toadflax seedlings are easily outcompeted by established plants, especially perennial species (Robocker 1970) and also by cheatgrass [*Bromus tectorum*] on fertile soils. Conversely, cheatgrass does not compete well with established Dalmatian toadflax plants (Robocker 1974). Cultivation or soil disturbance that removes perennial plants may increase Dalmatian toadflax seedling survival (Robocker 1970).”

Once established in an area it is aggressive and crowds out native species and wildlife forage (L. Moser and B. Phillips, personal observations, 2002 to 2003)

Sources of information: See cited literature. Also considered personal observations by L. Moser (Botanist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Flagstaff, Arizona, 2002 to 2003) and B. Phillips (Zone Botanist, U.S. Department of Agriculture, Forest Service, Coconino, Kaibab, and Prescott National Forests, 2002 to 2003).

Question 1.3 Impact on higher trophic levels Score: **Score: B Doc'n Level: Other pub.**

Identify type of impact or alteration: reduces native forage

Rationale: May become a problem by crowding out desirable wildlife forage (Burril et al. 2002); cattle avoid *L. dalmatica* and have preferential selection for native forage (thus further reducing natives for competition) (Lajeunesse 1999). Some species of birds and rodents may feed on seeds yet not heavily used by native species (Robocker 1970) or use it for cover (Lajeunesse 1999).

Sources of information: See cited literature.

Question 1.4 Impact on genetic integrity Score: **Score: D Doc'n Level: Other pub.**

Identify impacts: No known hybridization.

Rationale: Although Kearney and Peebles (1960) list *L. texana* Scheele as a native annual species in Arizona, the taxonomy has changed it to *Nuttallanthus texanus* (Scheele) D.A. Sutton (USDA 2005). There is no evidence that *L. dalmatica* (a perennial) will hybridize across genera.

From Saner et al. (1995): Hybridization did occur between *Linaria dalmatica* and *L. vulgaris* in a laboratory (Bruun 1937) and according to Sutton (1988) the occurrence of this hybrid in nature cannot be excluded. *L. vulgaris* is also a non-native plant to Arizona.

Sources of information: See cited literature.

<p>Question 2.1 Role of anthropogenic and natural disturbance in establishment Score: B Doc'n Level: Other pub.</p>
<p>Describe role of disturbance: Disturbance promotes toadflax invasion and may be necessary for establishment. However, once established, toadflax can spread into adjacent non-disturbed areas (Beck 2001).</p>
<p>Rationale: In North America, toadflax are most commonly found on disturbed sites such as roadsides, fencelines, areas near dwellings, vacant lots, cemeteries, gravel pits, croplands, clearcuts, pastures, waste areas, and other disturbed sites where removal of vegetation allows toadflax seedlings to establish (Carpenter and Murray 1998, Lajeunesse 1999). Toadflax can also establish and spread in sparsely vegetated areas and sites with naturally occurring disturbances, small openings, and/or little competition between species. Examples of such sites include dry, open areas in grassland and bunchgrass communities, sagebrush, open coniferous forests, sand dunes, riparian areas, and borders of woods (e.g. numerous authors see Carpenter and Murry 1998 and Zouhar 2003).</p>
<p><i>Linaria dalmatica</i> colonizes open spaces (Rocky Mountain National Park 1998) and exhibits a positive response to pre-monsoon prescribed burning but not post-monsoon prescribed burning (Phillips and Crisp 2001). <i>Linaria</i> increased in stem density, number of flowering stalks and percent cover one to three years following the Leroux Fire in 2003 under all fire severity categories and did so significantly in areas of high fire severity (R. Dodge, unpublished data, 2004). In the San Francisco Peaks, establishment has been observed due to small disturbances from elk (bedding down, migration) and birds (B. Phillips and L. Moser, personal observations, 2004).</p>
<p>Toadflax most commonly invades disturbed plant communities typical of cultivated areas, roadsides, and other "waste places." It also invades communities with naturally-occurring disturbances or small openings (Arnold 1982 in Zouhar 2003, Lajeunesse 1999)</p>
<p>Sources of information: See cited literature. Also considered unpublished data of R. Dodge (Master's student, Northern Arizona University, presented at San Francisco Peaks Cooperative Weed Management Area meeting, August 26, 2004) and personal observations of L. Moser (Botanist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Flagstaff, Arizona, 2004) and B. Phillips (Zone Botanist, U.S. Department of Agriculture, Forest Service, Coconino, Kaibab, and Prescott National Forests, 2004).</p>
<p>Question 2.2 Local rate of spread with no management Score: B Doc'n Level: Obs.</p>
<p>Describe rate of spread: Increases rapidly, but does not double in <10 years.</p>
<p>Rationale: Because Dalmatian toadflax can produce enough seeds to exceed potential emergence sites, and because Dalmatian toadflax plants reproduce vegetatively, it appears that individual seedling recruitment in Dalmatian toadflax is more important for establishing new populations than it is for maintaining established populations (Grieshop and Nowierski 2002). Roots of Dalmatian toadflax seedlings grow an average of about 2 inches (6 cm) per week, with the uppermost primary branch tending to grow horizontally at depths of 0.8 to 4 inches (2 to 10 cm) (Robocker 1974).</p>
<p>Growth models are in the process of being developed from data collected in the Coconino National Forest (R. Dodge, unpublished data, 2004). Dodge's observations during her field study 2002 to 2004 suggested that <i>Linaria</i> populations are increasing but not doubling in <10 years (R. Dodge, personal communication, 2004).</p>
<p>In Raymond Mountain Wilderness Study Area (Border Junction, Wyoming), D. Wilde (Undated) with the Lincoln County Weed and Pest District reported an infestation of Dalmatian toadflax has more than</p>

quadrupled since 1991. In Colorado, shoot density increased over 1200% in six years at one location and 190% over three years at another location.

Dalmatian toadflax plants are thought to live an average of 3 to 5 years. Dalmatian toadflax patches can persist for 13 years or more under favorable conditions. Dalmatian toadflax stands sometimes disappear for several years then re-establish, either from buried seeds or perhaps from vegetative root buds (Robocker 1974).

Sources of information: See cited literature. Also considered unpublished data and personal communication with R. Dodge (Master's student, Northern Arizona University, 2004) and report by D. Wilde (Lincoln County Weed and Pest District, available online at <http://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Invasive/natural.html>, Undated).

Question 2.3 Recent trend in total area infested within state Score: **B** Doc'n Level: **Obs.**

Describe trend: Increasing but not doubling in <10 years in total area infested.

Rationale: *L. dalmatica* is increasing in its range within Arizona but not rapidly.

Sources of information: Observations by L. Moser (Botanist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Flagstaff, Arizona, 2004) and Working Group consensus.

Question 2.4 Innate reproductive potential Score: **A** Doc'n Level: **Rev. sci. pub.**

Describe key reproductive characteristics: See Worksheet A.

Rationale: Reproduces by seed and extensive horizontal roots; prolific seed producer.

Sources of information: See Worksheet A and cited literature in the accompanying notes.

Question 2.5 Potential for human-caused dispersal Score: **A** Doc'n Level: **Other pub.**

Identify dispersal mechanisms: Equipment, human recreation, cattle (post digestion), horticulture industry.

Rationale: Equipment used in moving soil and gravel disperse vegetative root fragments that will establish elsewhere. Fuel reduction treatments (by humans), trail maintenance, and recreational use of the back country have the potential to spread seed and root fragments. Seed dispersal via farm equipment is likely an important mode of dispersal in agricultural areas.

Still being use as an ornamental (plant and seed) and people have a tendency to pick it because it is pretty. Formerly used as a folk remedy and fabric dye; do not know the current status of this.

Dalmatian toadflax may also be dispersed by cattle, deer and other browsing animals; seeds can remain viable after passing through the gastrointestinal tracts of cattle, and possibly deer (Robocker 1970).

Sources of information: See Carpenter and Murray (1998). Also considered Working Group member observations.

Question 2.6 Potential for natural long-distance dispersal Score: **C** Doc'n Level: **Obs.**

Identify dispersal mechanisms: Rare dispersal of more than 1 km

Rationale: Irregular wings on tiny seeds aid in wind dispersal and oily seed coats to enhance water and granivore dispersal. Nadeau and King (1991) observed that over 80% of yellow toadflax seeds fell within an 18-inch (50 cm) radius of the parent plant, and "very few" seeds fell more than 5 feet (1.5 m) from the parent plant. Average seed size is similar for yellow and Dalmatian toadflax. Dalmatian toadflax seeds are slightly heavier (Robocker 1970), and the papery wing surrounding the seeds is less developed on Dalmatian toadflax. This suggests that Dalmatian toadflax seeds probably also fall within short distances of the parent plant (Zouhar 2003). Yellow toadflax seeds may also be dispersed by

natural causes such as water, ants, birds, and rodents (Saner et al. 1995). It is inferred that this is true for Dalmatian toadflax as well.

Sources of information: See cited literature. Working Group also applied inference.

Question 2.7 Other regions invaded

Score: **C** Doc'n Level: **Obs.**

Identify other regions: only in areas invaded in AZ

Rationale: Ecological distribution in Colorado typically found between 5000 to 6500 feet in oak, aspen, sagebrush, mountain brush and riparian communities (Rocky Mountain National Park 1998). Dalmatian toadflax is said to be highly invasive and competitive in sagebrush (*Artemisia* spp.) ecosystems (Pyke 2000) and is often invasive in open ponderosa pine (*Pinus ponderosa*), bunchgrass, and riparian communities.

Dalmatian toadflax may displace natives in shrub-steppe communities in Washington (Rice and Randall 2003). It was found in trace amounts in ponderosa pine-bluebunch wheatgrass (*Pseudoroegneria spicata*) and ponderosa pine-Thurber needlegrass (*Achnatherum thurberianum*) habitat types in Washington and Idaho in the late 1960s (Daubenmire and Daubenmire 1968). In Oregon Dalmatian toadflax is found in bluebunch wheatgrass-Sandberg bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*)-bluebunch wheatgrass communities, and on gravel bars in riparian communities (Rice and Randall 2003).

In Montana Dalmatian toadflax forms large colonies in dry mountain grasslands of valleys and foothills (Lackschewitz 1991), on sites formerly dominated by native prairie species such as Idaho fescue and bluebunch wheatgrass. These sites are now dominated by Dalmatian toadflax, leafy spurge (*Euphorbia esula*), spotted knapweed (*Centaurea maculosa*), cheatgrass (*Bromus tectorum*) (Marler et al. 1999) and sulphur cinquefoil (*Potentilla recta*) (L. Moser, personal observation, 2003). In Glacier National Park, Montana, Dalmatian toadflax occurs in rough fescue (*Festuca altaica*)-Idaho fescue habitat types along roadsides (Tyser and Worley 1992).

In Yellowstone National Park, Wyoming Dalmatian toadflax was found at Mammoth Campground in a big sagebrush (*Artemisia tridentata*)/bluebunch wheatgrass habitat type. It was not found at campgrounds at higher elevations (Allen and Hansen 1999). Along the Yampa River area in Colorado, Dalmatian toadflax spreads in from adjacent upland areas and along the river. It is found in gravel bars, riparian pastures, and open meadows, and may compete with cottonwood seedlings for establishment sites on gravel bars. In Phantom, Colorado the river and trails are conduits to dispersal of Dalmatian toadflax. It may also invade mountain-mahogany (*Cercocarpus* spp.) shrubland and shortgrass prairie communities adjacent to riparian corridors (Rice and Randall 2003). In Utah, Dalmatian toadflax is found in oak (*Quercus* spp.), quaking aspen (*Populus tremuloides*), sagebrush, mountain brush, and riparian communities (Welsh et al. 1987)

Sources of information: See cited literature.

Question 3.1 Ecological amplitude

Score: **A** Doc'n Level: **Obs.**

Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Widespread, invades 10 minor ecological types in Arizona.

Rationale: Dalmatian toadflax is a native of the Mediterranean region from the coast of Croatia northeastward to Transylvania and Moldavia in northern Romania, southward and eastward around the Black Sea in the countries of Bulgaria, Albania, Greece, Crete, Turkey, Syria, Iran, and Iraq (Alex 1962 in Carpenter and Murray 1998). According to Saner et al. (1995) *Linaria* has a tolerance for low temperatures and coarse textured soils. In addition, can adapt their growth to fit a number of habitats

primarily occurring on sandy or gravelly soil on roadsides, railroads, pastures, cultivated fields, rangelands and clear cuts

From Zouhar (2003): the latitudinal range of Dalmatian toadflax in North America is from about 33° N to about 56° N (Alex 1962). Dalmatian toadflax is most common in western North America, especially in California, Oregon, Washington, Idaho, Montana, Wyoming, Alberta, and British Columbia (Carpenter and Murray 1998, Lajeunesse 1999), and it is spreading in the Southwest. For example, it is estimated to have invaded 200,000 acres (80,000 ha) on the Coconino National Forest in northern Arizona as of 2001 (Phillips and Crisp 2001).

First reported in North America as an ornamental in 1894 (Alex 1962 in Carpenter and Murray 1998); earliest authentic specimen collected in California in 1920 (Alex 1962 in Zouhar 2003). Persistent and aggressive invader in Colorado from 6000 to 8500 feet mostly on the Western Slope (Beck 2001). Earliest AZ record is 1955 (SEINet 2004). Dalmatian toadflax is found, though rare, in sandy soils and washes in oak woodland in Fort Bowie National Historic Site in southeastern Arizona (Warren et al. 1992). It is also found in northern Arizona in Bebb willow (*Salix bebbiana*) wet meadow, fescue (*Festuca* spp.)-muhly (*Muhlenbergia* spp.) grassland, and mixed conifer understory communities (Rice and Randall 2003).

Sources of information: Observations by several of the Working Group members. Also considered information from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: <http://seinet.asu.edu/collections>; accessed June 2004) and Southwest Exotic Plant Mapping Program (SWEMP) 2003 records (available online at: <http://www.usgs.nau.edu/swepic/swemp>).

Question 3.2 Distribution

Score: **A** Doc'n Level: **Obs.**

Describe distribution: Largest frequency of occurrence is in tundra (only one ecological type of tundra)

Rationale: See Worksheet B.

Sources of information: Observations by several of the Working Group members.

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Dense infestations produce >1,000 viable seed per square meter	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Populations of this species produce seeds every year.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Seed production sustained for 3 or more months within a population annually	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Seeds remain viable in soil for three or more years	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Viable seed produced with <i>both</i> self-pollination and cross-pollination	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	1 pt.
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Fragments easily and fragments can become established elsewhere	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Resprouts readily when cut, grazed, or burned	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Total pts: 11 Total unknowns: 0			
Score : A			

Note any related traits: According to Robecker (1974), with minimal competition and good moisture availability a Dalmatian toadflax plant with 10 stems could potentially produce 500,000 seeds and remain dormant for up to 10 years. Over 90% germination has been obtained with 2 to 3 year-old seeds in a laboratory (Rocky Mountain National Park 1998). Vegetative buds give rise to new shoots as early as nine weeks (Robecker 1974). According to Zimmerman (1996), vegetative reproduction from root buds can occur as early as 2 to 3 weeks after germination. Root buds are not killed by fire and removal of top growth can stimulate production of vegetative shoots (Lajeunesse 1999). Self-incompatible and rely on insects for pollinations (Vujnovic 1997 in Zouhar 2003). Life span is up to five years with an average of 3.8 years (Robecker 1974).

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	C
	southwestern interior chaparral scrub	D
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	C
	plains and Great Basin shrub-grassland	D
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	C
	montane riparian	C
Woodlands	Great Basin conifer woodland	C
	Madrean evergreen woodland	D
Forests	Rocky Mountain and Great Basin subalpine conifer forest	C
	montane conifer forest	B
Tundra (alpine)	tundra (alpine)	A

*A means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

The following table provides some elevation ranges for Dalmatian toadflax by geographic area (from Zouhar 2003)

Area	Elevation	References
Nevada	3,000 to 7,000 feet (900 to 2,100 m)	Kartesz (2002)
New Mexico	5,000 to 6,000 feet (1,500 to 1,800 m)	Martin and Hutchins (1981)
Utah	4,400 to 10,000 feet (1,300 to 3,100 m)	Welsh et al. (1987)

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